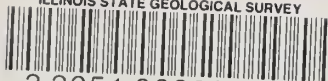



ILLINOIS STATE GEOLOGICAL SURVEY



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STATE OF ILLINOIS
DWIGHT H. GREEN, *Governor*
DEPARTMENT OF REGISTRATION AND EDUCATION
FRANK G. THOMPSON, *Director*

DIVISION OF THE
STATE GEOLOGICAL SURVEY
M. M. LEIGHTON, *Chief*
URBANA

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THE HISTORICAL DEVELOPMENT OF THE
ILLINOIS COAL INDUSTRY AND THE
STATE GEOLOGICAL SURVEY

BY

M. M. LEIGHTON and DON CARROLL

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THE HISTORICAL DEVELOPMENT OF THE ILLINOIS COAL INDUSTRY AND THE STATE GEOLOGICAL SURVEY *

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Coal mining in Illinois, as a commercial enterprise, dates back to the year 1810, when a drift mine was opened in the bluff bordering the Big Muddy River, several miles below Murphysboro. That pioneer mining locality, known as Mount Carbon, was developed for the purpose of recovering and marketing an excellent grade of blacksmith coal, from a bed that later generations of coal men were to discover was superior in quality to any others occurring in Illinois.

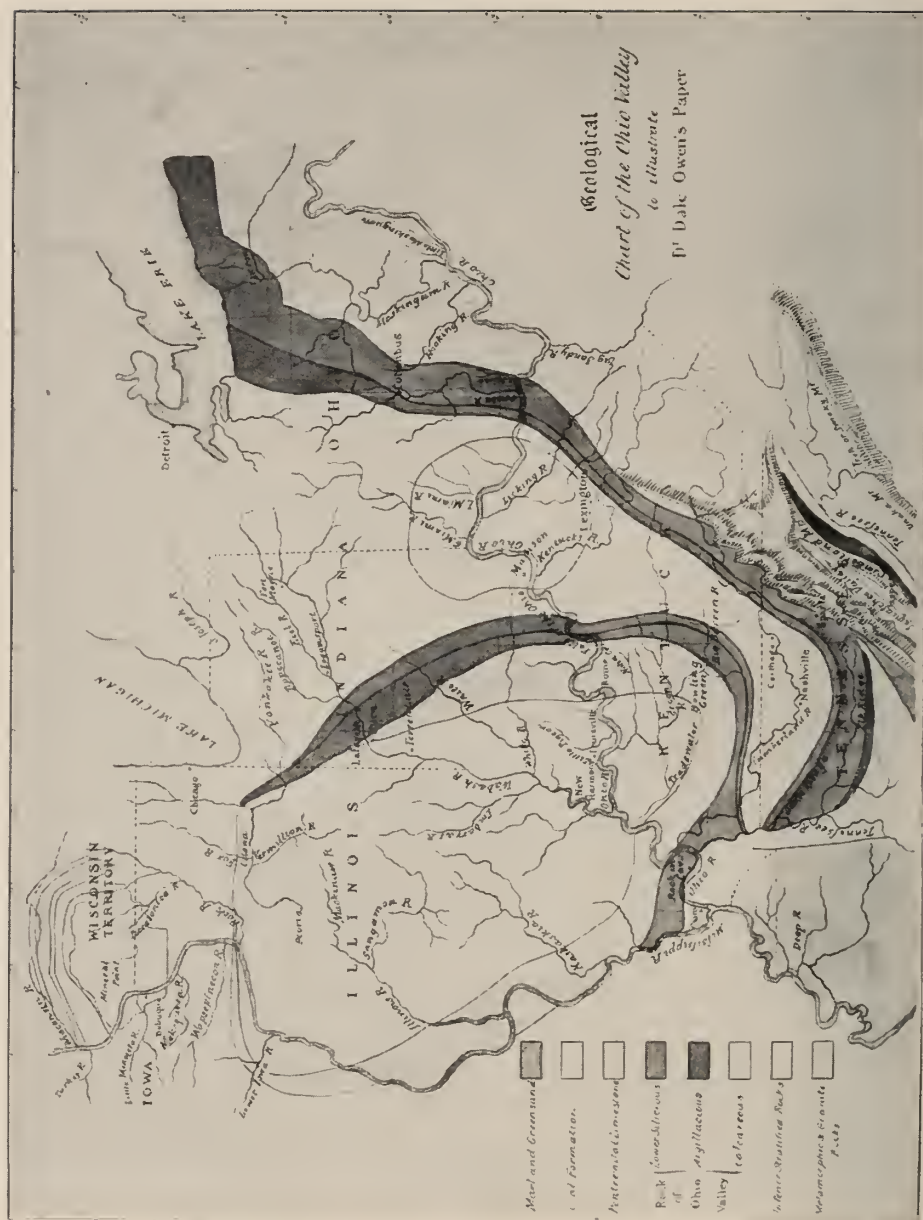
This first mining venture was initiated 137 years after the white man made his first discovery of coal in North America—a discovery that is now definitely credited to Pere Marquette who, in 1673, noted and recorded the presence of an outcropping coal bed near the site of the present town of Utica, in La Salle County, Illinois.

There is no record of any supplementary coal mining activity in Illinois until the year 1830, when a St. Clair County blacksmith began mining the Belleville bed, opposite St. Louis. Apparently a number of drift mines were in operation in that vicinity no more than a year later, for coal was being sold in St. Louis in 1831 at a top price of 12½ cents per bushel. Considerable amounts of coal were undoubtedly being mined by that time in various other parts of the State, although no production figures were collected by the government until 1833. In that year, 6,000 tons were hauled to St. Louis from the Belleville district alone. The U. S. Census Report for 1840 took notice of production in 19 separate counties in Illinois, which produced a grand total of approximately 17,000 tons.

By this time, governmental authorities had begun to take notice of the new science of geology, and the potential value of geological studies for locating and mapping mineral resources. The Federal Land Office, in 1839, commissioned Dr. David Dale Owen to conduct geological studies over a large area of the Middle West—in Ohio, Indiana, Kentucky, western Tennessee, Illinois, Iowa, Missouri, and southern Wisconsin. He and his associates made a systematic study of this large area, and their first report, with maps, was published in 1844. Other reports and maps were published by Owen up to 1852. The studies supplied the first relatively accurate geological information regarding the central interior coal fields, and attracted considerable interest.

Governor French, in a message to the Illinois legislature on January 7, 1851, recommended legislation to establish a geological survey in

* Special acknowledgement is made for source material published in "A Compilation of the Reports of the Mining Industry of Illinois," 1931; by John G. Milhouse, Director, Department of Mines and Minerals.



The first geological map of the north central states, published by Dr. David Dale Owen in 1844, shows in general the location and extent of the eastern interior coal field, and the areal geology of the surrounding region.

Illinois. "We have unmistakable evidence," he said, "that this state is scarcely excelled in the extent of her mineral riches, and all that seems wanting to render them richly productive is to point attention to them. As some considerable time will be required for a careful and minute geological survey of the whole state, I would respectfully suggest whether its importance would not justify a limited appropriation, to be followed by others thereafter, as the results and prospects of success might render desirable."

A few weeks later a bill was introduced and passed, providing for the appointment of a geologist and outlining his duties. Dr. J. G. Norwood was appointed State Geologist, and began his work in October, 1851. He continued to serve until 1858 but, except for a small, approximately accurate geological map of the state, prepared very little material for publication. His sole contribution in the way of a published report was a brochure of less than 100 pages—mostly coal analyses and diagrams of local geological sections.

In the meantime, the coal industry was expanding rapidly in Illinois, in harmony with the rapid construction of railroads. Before 1850 there were but 59 miles of railroad lines in the State. Ten years later 2,781 miles of track had been completed and was in use. Coal production in Illinois increased from 260,000 tons in 1849, to 728,400 tons in 1860, and reached the million-ton mark by 1864.

The rapid growth of mining activity, and the need for authoritative geological data to guide development, made necessary the continuation of a geological survey. Consequently, Norwood was succeeded as State Geologist by Mr. Amos H. Worthen, who assumed office in March, 1858, and immediately began to carry out the ambitious program of preparing separate detailed reports on the geology and mineral resources of each county in the State. Because of his wide acquaintance and scientific prestige, he was able to secure the services of a number of well trained assistants, and the work went forward rapidly.

Field work was carried on for 12 years until appropriations were discontinued. Funds were provided, however, for the preparation and printing of reports until 1875, by which time reports had been published for all but one county. The eight large volumes ultimately published by Worthen represent a prodigious accomplishment, and these reports are even yet regarded as excellent reference works among American geological literature. Among pioneer geologists, Dr. Worthen was indeed outstanding.

In this period, during and following the Civil War, considerable progress was made in developing our coal resources, and even in making use of machinery in mining operations, since the steam engine was then finding universal application. Some noted Illinois mining districts had their beginning between 1860 and 1890, particularly those that are removed from river transportation facilities. The building of the railroads made this "inland" development possible.

In 1865 coal was found in the digging of a well in Will County. This discovery began mining in the Wilmington district, and operations were soon under way there on a large scale. The Vermilion County field was

opened in 1866, along Grape Creek. The first mine there was a stripping operation. By 1870, commercial coal mining was under way in 37 counties, and the State produced 2,624,163 tons that year. Nearly a third of this total was produced in St. Clair County. Will, Vermilion, Rock Island, Perry, Madison, La Salle, and Jackson counties led the rest of the list. There was as yet no mining in Franklin, Jefferson, or Saline counties, and only minor activity in Williamson County. The Grundy County deposits were opened on a commercial scale in 1874. In 1880 the production of coal in Illinois amounted to some six million tons, produced in 46 counties.

Operators began making yearly reports to the State in 1882. In that year there were 704 mines reporting, of which 207 were "steam shafts," 140 "horse power shafts," 9 were classified as "steam slopes or shafts," and 329 as "other slopes or drifts." Employees numbered 20,300 and the capacity of the mines was rated at about two times the production figure of that year.

The State Coal Report for 1883 contains the first recorded notice of mine improvements, giving specific mention of the enforcement of mining laws pertaining to ventilation and the construction of escapement shafts. During that year, 42 mines completed escapement shafts, and others were in process of construction. The report notes a general disposition to comply with the law. By the end of 1886, there were 310 mines in the State with escapement shafts, and ventilating fans had been installed in 152 of them. The law also required certain safety precautions, such as means of signalling between top and bottom, safety catches and guides on cages, brakes on drums, etc. These requirements were generally met.

The first mention of the use of screens at Illinois mines is to be found in the "Platform and Constitution of the Re-organized Miners of St. Clair and Adjoining Counties," which was published in the *Belleville Democrat* in August, 1875. In this interesting document, the miners specified that "That no coal shall have a screen to exceed one inch between the bars . . .," and "That we demand three cents per bushel for mining, and will take no less." Again, in the Coal Report for 1886, it was reported that screens were in use at 218 mines, and that 80 per cent of the product was screened before being sold. It was stated that "much the largest number of screens have a space between the bars of seven-eighths of an inch, with an average area of sixty square feet. This is regarded as a standard screen, and is used by all of the larger companies."

In 1888 the Coal Report gave, for the first time, figures on the use of undercutting machines, noting their use in 38 mines—approximately one-eighth of the mines then in operation. In 1887 the first electric mine locomotive was completed and put into service under ground. This was of the "Pioneer" type. In 1891 the "Terrapin Back" type was placed in service, to be displaced by the predecessor of the modern locomotive in 1895 and later. In 1900 there were seven mines using motor haulage. Other methods of haulage that year were: Cable (27 mines), horse and mule (512 mines), and hand (374 mines).

Before 1923 very little progress had been made in mechanical loading practice, and in that year no more than two million tons were thus handled in the entire United States. Rapid application of this method took place in the following years, though, and a 70 per cent increase was recorded by 1925. The first record of the use of these machines in Illinois mines appears in the Coal Report for 1927, when 129 of them were in operation in 21 mines, loading 1,657,858 tons. A year later there were 992 machines in use here in 51 separate mines, and they handled 6,742,154 tons of coal. In 1930 there were 2,238 loading machines in use in the State, and they handled more than half of the 45,776,272 tons mined that year in Illinois shaft mines.

Strip mining, which began in Illinois with the opening of the Grape Creek district, in 1866, has been continuous ever since. With the invention and spectacular improvement of stripping equipment, coal beds lying as much as 60 feet below cover can now be mined by this method in competition with shaft mines. Not until 1923, however, did strip-coal mining in Illinois reach the million-ton mark.

During the 30-year period between 1875 and 1905, there was no geological survey organization in Illinois. Had there been one, it would have been of great aid to the mineral industries of the State, at a time of rapid industrial expansion. So evident was the need for such an organization that a number of prominent Illinoisians formed an influential group to bring about its re-establishment, due mostly to the efforts of Mr. A. Bement, Consulting Engineer, of Chicago, who also sponsored a petition which the Western Society of Engineers prepared at a special meeting in February of 1905, calling for the establishment of a State Geological Survey, and pointing out the need for such an organization. The petition was widely circulated throughout the State.

The public-spirited men comprising the committee included professional geologists, such as Professors T. C. Chamberlin and R. D. Salisbury of the University of Chicago, Professor U. S. Grant of Northwestern University, and Dr. J. A. Udden of Augustana College, Rock Island. Engineers, such as A. Bement and his associates in the Western Society of Engineers, and coal operators led by Francis Peabody, Carl Scholz and others, felt that the mineral industries definitely needed the foundation that only a well-rounded-out geological survey could supply. All these men believed, as has since proved to be the case, that the consequent value to industry would repay many times the necessary expenditure of public funds for the public welfare. It was felt that Illinois should regain its former leadership in the study of fundamental geology and the application of the knowledge thus gained to education and industry alike.

The movement was enthusiastically backed by Governor Charles S. Deneen and President Edmund James, of the University of Illinois, and in 1905 the General Assembly passed an act to establish the present State Geological Survey. Its duties were defined in the act, and funds were appropriated for investigations and publications. Its control and supervision were placed in the hands of a commission comprised of the Governor, the President of the University, and Professor Chamberlin,

who was doubtless the outstanding geologist of the time. In September of that year the commission chose Dr. H. Foster Bain as Director of the Survey, and he began his work a few weeks later. Highly-trained scientists were secured to make up his staff, and the new Survey immediately inaugurated a sound program of investigations, concentrating its efforts, for the most part, on coal and clay studies.

Close relations were established with the Engineering Experiment Station of the University, at that time under the direction of Professor L. P. Breckenridge. Dr. Edward Bartow, then Director of the State Water Survey, was equally cooperative, as were many other members of the University faculty. The new organization was especially fortunate in having available the services and counsel of Professor S. W. Parr, whose fame as a leading figure in coal research remains undimmed. His wide knowledge of coal, his devotion to research, his sound judgment and fine character made him a valued consultant in the work of the Geological Survey over a period of more than two decades.

The coal industry was expanding rapidly and many problems required investigation and solution. Consequently Dr. Bain directed most of the efforts of the Geological Survey toward studies of the stratigraphy of the "Coal Measures" rocks, the distribution and correlation of the commercial coal beds, the collection of data relating to their origin and mode of deposition, as well as their relationships to associated strata, and studies of the composition and uses of the various coals of the State.

In cooperation with the Engineering Experiment Station, the U. S. Geological Survey and Bureau of Mines, and the State Department of Mines in Springfield, together with various coal companies and mining men, a number of interesting and important technological studies were undertaken. Dr. J. J. Rutledge of the Maryland Department of Mines, and Tom Moses, who later became officially connected with the U. S. Steel Corporation, both spent much time sampling coal beds for the Survey. W. L. Abbott, of the Commonwealth Edison Company, personally studied spontaneous combustion and weathering of coal in storage piles. J. A. Holmes, George S. Rice, and other pioneer safety men of the Bureau of Mines, gave their counsel and established at the University the first Mine Rescue Training Station outside of Pittsburgh.

When Dr. Bain withdrew from the direction of the Geological Survey in 1909, he had in only four years set it on a wise and comprehensive course which it has since followed. He had also established fine relations with State officials and members of the legislature, with educational leaders, technical societies, and with responsible and forward-looking men in the mineral industries. He was succeeded by Frank W. DeWolf, who remained at the head of the Survey until 1923.

Soon after DeWolf took over the administration of the Survey, the inadequate space that had been assigned to it in the Chemistry Building was vacated in favor of more commodious quarters in the adjacent Natural History Building. In 1916, upon the completion of the Ceramics Building, the Survey moved to still larger quarters there, where headquarters were maintained for approximately 25 years.

During the period of DeWolf's term as Chief of the Survey, a notable list of coal studies were carried through to completion, and many con-

tinuous research projects were begun. Since the "Coal Measures" cover about three-fourths of the State, and our coal beds represent by far the most important mineral resource, the study of the coals was naturally emphasized. The detailed surveys in southern Illinois, begun in 1906, were continued under the direction of George H. Ashley of the U. S. Geological Survey. David White, also of the U. S. Geological Survey, had by this time made considerable progress in his studies of the plant fossils of the Illinois "Coal Measures" strata, and had fixed the top of the Pottsville formation, as well as determining that our widespread coal No. 6 lies at or near the horizon of the Freeport coals of Pennsylvania, near the top of the Allegheny formation. Thus, the Illinois section was now approximately correlated with that of the East.

This work, and other coal investigations that were outlined under Dr. Bain's administration, were extended in larger quantity and more broadly under DeWolf. This program consisted of the routine collection and study of innumerable drill records from the mining companies, the geological mapping of quadrangles in various mining districts, and the mapping of the extent of the coal beds and their structural features. In this early work, the State men engaged included G. H. Cady, T. E. Savage, J. A. Udden, Jon Udden, and E. F. Lines. Federal men assigned to cooperate with the State under supervision of George H. Ashley, and later of David White, included E. W. Shaw, Henry Hinds, and Wallace Lee. During this period the assistance of Mr. A. Bement, Consulting Engineer of Chicago, was particularly helpful.

These activities increased with the establishment of the Illinois Mining Investigation under a cooperative agreement with the Department of Mining Engineering of the University and the U. S. Bureau of Mines. The legislature made special appropriations for work of the State agencies, and the Federal Department made substantial allotments. As a result, a group of geologists, mining engineers, and chemists carried on a systematic investigation which lasted some ten years and resulted in many fine researches and publications. This work was based on topographic maps, where possible, but could not await their slow preparation, and therefore land maps were compiled for the entire coal field, in various units. The results included an inventory of coal resources, studies of mining practices with special reference to safety and efficiency, and determination of chemical and physical characteristics as affecting usability of Illinois coal for ordinary purposes, and for coking and for gas manufacture. During this period, especially close cooperation was extended by University representatives, including Professor Stoek of the Department of Mining Engineering, Professor Parr of the Department of Applied Chemistry, and Dean Richards of the Engineering Experiment Station, as well as with Joseph A. Holmes and Van H. Manning, directors of the U. S. Bureau of Mines, and with officers and inspectors of the State Mining Department. The notable series of publications included 17 bulletins by the Survey, 15 by the Engineering Experiment Station, and 9 bulletins and 7 technical papers by the U. S. Bureau of Mines. The Survey employees chiefly engaged in this work were F. H. Kay, Assistant State Geologist, in charge; K. D. White, G. H. Cady,

geologists; L. E. Young, mining engineer; J. M. Lindgren, chemist; W. A. Dunkley, chemist and gas engineer. In all of the Survey's coal investigations, it had the support and cooperation of the officers and members of the coal operators' associations, and of the mining engineers and of fuel and gas experts in company employ. The contribution to the knowledge of Illinois coals, to their safe and effective mining and preparation, and their improved utilization was of considerable industrial importance to the State.



Three men have headed the State Geological Survey since it was established in 1905. Dr. H. Foster Bain (center) served from 1905 to 1909. Professor Frank W. De Wolf (left) succeeded Bain and held the office until 1923. Since that date Dr. M. M. Leighton (right) has been chief, and can look back on two decades of accomplishment.

In 1923, Dr. M. M. Leighton became Chief of the Geological Survey. Under his direction it has expanded greatly in personnel, physical plant, facilities for research, and concept of maximum service to the State. His sponsorship of this program has made the Illinois Geological Survey outstanding in its field and has won the support of the mineral industries.

In 1930 the Geological Survey celebrated its 25th anniversary with a program that attracted a large attendance of geologists, and coal and other mineral specialists from many states. The program emphasized not only what had been accomplished in the preceding quarter-century, but what should be done in the future. This meeting inspired the formation of the Illinois Mineral Industries Committee, state-wide in scope and embracing the interests of the mineral industries, scientific organizations, engineering and business interests. Its first chairman was the late Joseph D. Zook, who at that time was president of the Mining Institute. Through his influence the Institute transmitted to State officials a resolution requesting expansion of the research program of the Geological Survey. T. J. Thomas later served in a like capacity as chairman of the Mineral Industries Committee. The enthusiastic interest and aid of W. D. Jenkins and Glenn A. Shafer are also gratefully acknowledged as



Headquarters of the State Geological Survey are located in the new Natural Resources Building, on the south campus of the University of Illinois, Urbana.

especially outstanding, as well as many other individual members of the Mining Institute. From the deliberations of these men there developed a broad realization of the true importance of the mineral resources of Illinois. As a result, a broad, long-term program of mineral research was planned and inaugurated within a few months. A number of specialists were appointed to the Survey staff, and the new program was given a trial in temporary "pilot plant" quarters provided by the University.

By 1937 the wisdom of carrying on this expanded program of mineral research had become unquestionably established, and appropriations were made by the General Assembly, with Governor Horner's approval, to provide adequate facilities and permanent new quarters for the continuation of the work.

The new Natural Resources Building was completed in the summer of 1940, with spacious offices and service rooms, and ideally designed laboratories that have been equipped with up-to-the-minute apparatus and facilities for an intensive and flexible program of research along many lines—in subsurface studies, in chemical analysis and research, in physics and engineering, in x-ray, spectographic and microscopic investigations, in mineral separation, beneficiation and utilization, and in mineral economics.

A supplementary building, the Geological Survey Research Laboratory, was also constructed in 1940 and 1941, alongside the new University Power Plant. This smaller building was planned to provide quarters for investigations requiring large-size equipment or equipment that needs to



Geological Survey investigations requiring the use of large-scale equipment, or equipment that produces dust or smoke, are carried on in the new Research Laboratory, near the University Power and Heating Plant.

be isolated for reasons of safety or cleanliness. In this building are carried on the Survey's investigations of coal briquetting, stoker coals, cleaning and preparation, coking and by-product possibilities.

The present program of coal research is planned so as to benefit both producers and consumers of Illinois coal. Problems of utilization, of marketing, of meeting rigid coal specifications, of combustion, storage, smoke elimination, preparation, processing, and even the mining of the coal itself, are all being studied assiduously. Special attention is called to the studies of banded ingredients of Illinois coal—studies that have already effected improvement in the quality and performance of stoker coals marketed by Illinois producers, and that promise to furnish the basis for still more important developments in the future.

From the first, the State Geological Survey has been intimately concerned and identified with the discovery and development of the mineral resources of Illinois. Naturally, coal has received a lion's share of scientific attention. Petroleum is undoubtedly second in importance, followed by a variety of valuable stone deposits, clays and shale, sand and gravel, silica sand, fluorspar, lead and zinc ores, tripoli, molding sand, and fuller's earth. All these natural substances are under continual investigation, and the possibilities for their further improvement and usefulness are being demonstrated through research.

Publication of the results of these studies, plus the policy of the Geological Survey to promote and encourage consultations and discussions with men in the industries, has resulted in making directly available to these men the benefits and suggestions that are born in the laboratory. Their reactions and suggestions, in turn, have proved valuable guides in planning and pursuing the researches themselves. The scientist and producer have thus come to recognize common interests and goals and are hence working in unison for the sound development of our resources.

